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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Venkat Selvamanickam, et al.		
Title:	APPARATUS FOR HIGH-THROUGHPUT ION BEAM-ASSISTED DEPOSITION (IBAD)		
App. No.:	10/602,467	Filed:	June 23, 2003
Examiner:	Brian K. Talbot	Group Art Unit:	1762
Customer No.:	34456	Confirmation No.:	2664
Atty. Dkt. No.:	1014-SP103		

MS AF
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. §1.132

Sir, I hereby declare and state:

1. I am a joint inventor of the subject matter presently claimed in the above-identified patent application.

2. I received my doctorate degree in Materials Engineering from the University of Houston in Houston, TX in 1992.

3. I have been employed by IGC/SuperPower, Inc. since 1994, wherein I have been mainly engaged in research and development of superconducting materials, superconducting conductors, and processes for forming same.

4. I have reviewed the Office Action dated October 18, 2005, including the positions taken by the PTO with respect to several prior art references. I have also particularly reviewed the subject matter of US5650378 (Iijima '378), US6214772 (Iijima '772), US2004/0168636 (Savvides), US5236509 (Sioshansi), US6236136 (Maishev), and 6783637 (Slaughter). For the reasons discussed below, Iijima '378, Iijima '772, Savvides, Sioshansi, Maishev, and Slaughter fails to disclose (or suggest) all features of the claimed invention.

5. The claimed invention is drawn to a method of coating at least one substrate with a buffer layer. The at least one substrate can be multiple segments of a substrate, multiple substrates, or a combination thereof. The method particularly includes feeding the at least one substrate through a deposition zone of a vacuum deposition chamber wherein a coating is applied while the at least one substrate is bombarded by ions from a dual RF-ion source. The dual RF-ion source includes a first and a second RF-ion source aimed at respective first and second portions of the at least one substrate. Additionally, a separator is disposed between the first and second RF-ion source. The separator longitudinally bisectes the substrate block and functions to barricade impingment of ions from the first RF-ion source on the second portion and from the second RF-ion source of the first portion.

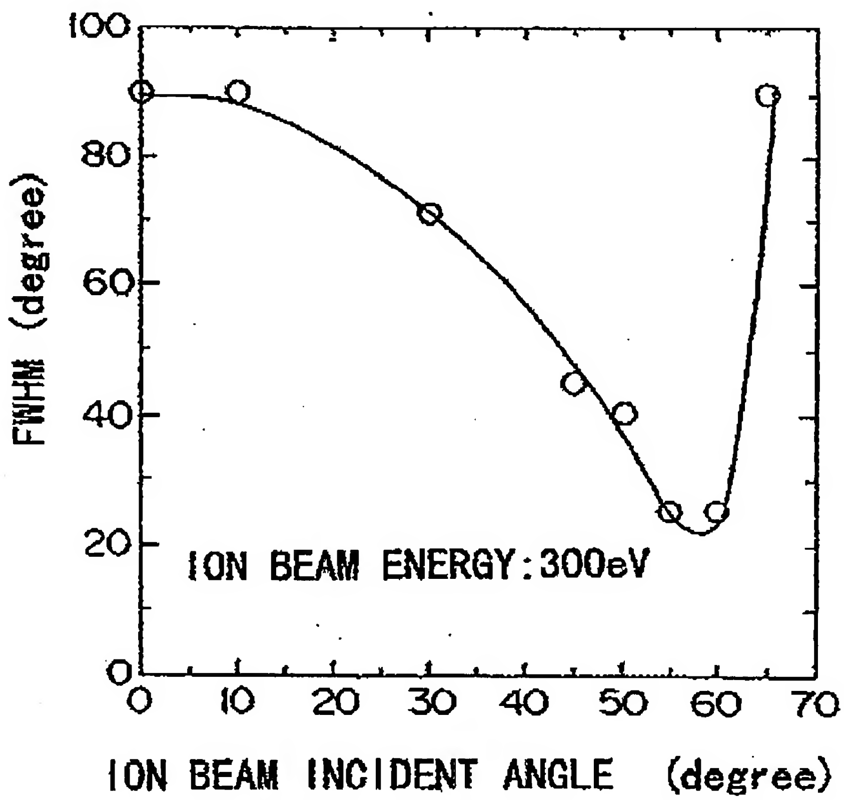

Figure 1 Full-width half-maximum (FWHM) as a function of ion beam incident angle.

It is emphasized that the incident angle of the ion beam to the depositing buffer layer is critical in the formation of the biaxial texture of the buffer layer. Small changes in the incident angle can result in significant differences in the texture of the buffer layer, resulting in a buffer

layer unsuitable for the formation of a superconducting material. Figure 1 shows the relationship between the incident angle and the texture of the resulting buffer layer measured by the full-width at half-maximum (FWHM). The optimal angle is about 55°, resulting in a FWHM of about 20°, albeit small changes result in poor texture, which would be unacceptable for the formation of a superconducting layer.

Additionally, the quality of the texture depends on the ratio of the ions from the RF-ion source to the atoms from the depositing source. Too many ions arriving at the substrate result in significant removal of buffer material and deposition is slow. Too few ions arriving at the substrate results in poor texture and an inferior buffer film. Figure 2 shows the ion beam current profile across the width of the ion beam measured at the substrate location. Accordingly, I found that only the central portion of the ion beam is useful in the formation of a high quality buffer layer and any substrate outside of the 6 cm zone experiences a lower ion current and results in a poor texture due to the reduced ion to atom ratio.

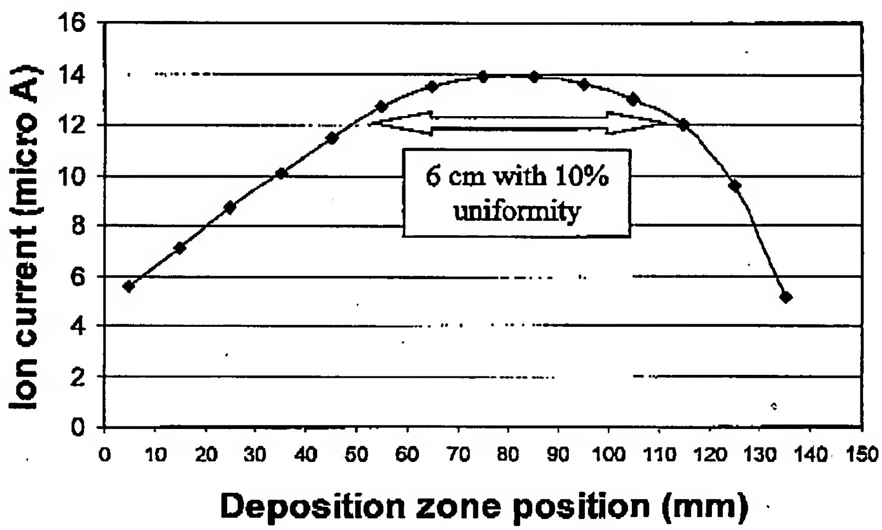

Figure 2 Ion beam current profile across the width at the substrate location obtained using a 6 cm wide ion beam assist source.

The size of the deposition zone is limited by the incident angle and the uniformity of the ion beam intensity, limiting the number of substrate segments that can be simultaneously processed. I discovered that in a process using multiple RF-ion sources to increase the size of the deposition zone, a separator is necessary to prevent stray ions from affecting the texture of

the buffer layer. In particular, stray ions affect the deposition of the buffer layer in two ways. First, the stray ions strike the substrate at greater than 55° resulting in poor texture. Additionally, the stray ions increase the ion to atom ratio, reducing the rate of deposition. The separator serves to prevent stray ions from the first RF-ion source from impacting the substrate segments within the second portion of the deposition zone and to prevent stray ions from the second RF-ion source from impacting substrate segments within the first portion.

6. In contrast, Iijima '378 and Iijima '772 disclose processes for deposition of a buffer on a substrate using a single RF-ion source. Iijima '378 and Iijima '772 fail to recognize the challenges associated with processing multiple substrate segments using multiple RF-ion sources within a single deposition zone. In particular, the need to prevent stray ions from impacting the substrate segments. Savvides discloses a process of using two ion beams impacting the same area of the substrate to improve the texture of the buffer film. Sioshansi discloses a modular system for coating a substrate. Specifically, Sioshansi discloses the use of multiple deposition chambers, each having separate RF-ion sources. Maishev discloses multiple ion beams for the treatment of a substrate. The ion beams overlap so as to ensure uniformity in the distribution of the ion currents. However, Maishev is not directed to ion beam assisted deposition (IBAD), and thus is not concerned with the angle of the ions striking the substrate. As such, Maishev fails to recognize the challenges associated with an IBAD system using multiple ion sources striking separate portions of the deposition zone. The PTO acknowledges that Iijima '378, Iijima '772, Savvides, Sioshansi, and Maishev fail to teach a separator between the two RF-ion sources.

Slaughter discloses a system for deposition of material from two sources onto a substrate. A first ion beam causes sputtering of material from a first target, and a second ion beam causes sputtering of material from a second target, such that material sputtered from the first and second targets are deposited on the same area of a substrate. A separator is included to prevent material from the first target from contaminating the second target and material from the second target from contaminating the first target. Slaughter does not teach or suggest a separator oriented as claimed (between ion sources), and certainly not a separator functioning to barricade impingement of ions from the first RF-ion source on the second portion and barricade impingement of ions from the second RF-ion source on the first portion.

As such, the combined teachings of Iijima '378, Iijima '772, Savvides, Sioshansi, Maishev, and Slaughter fail to disclose or suggest a separator oriented as claimed and functioning to barricade impingement of ions from the first RF-ion source on the second portion and barricade impingement of ions from the second RF-ion source on the first portion.

7. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like, so made, are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Date

Venkat Selvamanickam